



Software Track Reconstruction

Hadrien Grasland

22-11-2019

Proposed deliverables

- **Develop core tracking algorithms, integrated with the Acts toolkit. Integrate Trick-Track with ACTS.**
 - 24 PM (8 EU)
- **Develop machine learning tracking algorithms that are promising, e.g. graph-NN approach.**
 - 24 PM (8 EU)
- **Prototype offload of Acts tasks to accelerated computing devices, using a device agnostic toolkit**
 - 12 PM (4 EU)

D3.1 : Core tracking algorithms

- **Make ACTS competitive with experiment-specific toolkits on classic HEP track reco algorithms :**
 - Cellular automaton seeding
 - Conformal mapping
 - Kalman filter, Gaussian Sum Filter...
- **Integrate Trick-Track with ACTS**
 - Standalone port of CMS CA seeding, interest from FCC

D3.2 : Machine learning based tracking

- **Ongoing area of intense research**
 - Possible path to survive combinatorial explosion ?
- **Lots of approaches were & are being explored**
 - Prototypes from the TrackML challenge
 - New approaches, e.g. graph neural nets
- **Goal : Evaluate & integrate best candidates in ACTS**

D3.3 : Heterogeneous hardware for tracking

- **Hardware landscape is changing fast**
 - GPU support is becoming a must, e.g. on HPC
 - EPYC surprise of CPU world, could happen to GPU too...
 - What's coming next ? FPGAs ? Dataflow Engine ?
- **Can't afford to one code path per chip**
 - Need ~unified code base running decently ~everywhere
- **To be explored : SyCL, DPC++, Alpaka...**

Feasibility and person-power

- **Seems achievable as-is given proposed resources**
 - Need a 2-year postdoc @ LAL, that's the 20 EU-PM
 - Enough local staff for ML research (2 permanent, 1 PhD)
 - Existing ACTS knowhow from AIDA-2020 + CERN team
 - Knowledge + local community on heterogeneous HW
- **Need to coordinate with CERN & DESY for precise evaluation of available resources**

Leading institute

- **Proposed lead institute : LAL**
 - Proposed task leader : Hadrien Grasland